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1. Your reference

   30002388 GB

2. Patent application number
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   0004067.5 21 FEB 2000

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

   Hewlett-Packard Company
   3000 Hanover Street
   Palo Alto
   CA 94304, USA

   Patents ADP number *(if you know it)*

   4965880001

   If the applicant is a corporate body, give the country/state of its incorporation

   Delaware

4. Title of the invention

   Recordings with Associated Location Data

5. Name of your agent *(if you have one)*

   "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

   Robert F. Squibbs
   Hewlett-Packard Ltd, IP Section
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   Patents ADP number *(if you know it)*

   4077642003

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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   a) any applicant named in part 3 is not an inventor, or
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Description	17
Claim(s)	2
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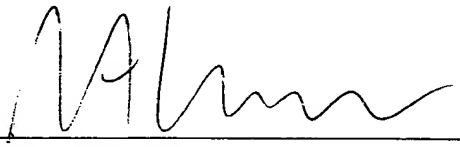
11. I/We request the grant of a patent on the basis of this application.

Signature  Date 21/2/09

Richard A Lawrence

12. Name and daytime telephone number of person to contact in the United Kingdom

Janet Smith, 0117-312-8026

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Recordings with Associated Location Data

Field of the Invention

The present invention relates to associating location with recordings and how such associations can be used. As used herein, recording includes single photographs, sequences of photographs, and video recording (all whether chemical or digital), sound recordings, etc.

Background of the Invention

Classification of photographs, particularly those taken by individuals and families, has long been a problem due to the effort involved in maintaining any organisation of the photos. The advent of digital photography does not, of itself, provide a solution. What is needed is a logical organisation, valid over a lifetime, that requires minimal effort to implement and is intuitive to use when retrieving photos.

It has been previously proposed to associate location (and orientation) data with digital photos. The location data can be derived in any suitable manner such as from a GPS system or by using information obtained from a cellular radio system. Thus, IBM Technical Disclosure 413126 teaches a digital camera provided with a GPS receiver. US 5,712,679 discloses a locatable portable electronic camera which is arranged to send back image and location data when triggered, the location data being displayed on a map and the image being shown separately. US 5,389,934 describes a portable locating system with a GPS unit that is operative to store a travel history of locations visited.

Summary of the Invention

In one aspect, the present invention disclose a photo-classification method in which a digital photo and associated location data are input into an electronic photo album which then utilizes the location data to classify the photo and represent it on a map display by an appropriate icon (which could be a thumbnail of the photo). Clicking (or otherwise selecting the icon) causes the photo to be displayed. Classification is thus automatic but

enables a user to readily retrieve photos by location which is a natural way of looking for photos

Similar albums can also be used for other types of recording such as sound recording or video recordings.

Other aspects of the invention are set forth in the accompanying claims

Best Mode of Carrying Out the Invention

Figure 7 depicts an embodiment of the invention in which a digital camera 100 provided with location determining means (such as a GPS receiver) is used to generate digital photos, each photo 101 being stamped with location data indicating where the photo was taken. The photos are downloaded by any suitable means (USB connection, removable storage device, etc) into a PC 102 where classification program serves to store the photos in a store 103 (which may be on the PC or external). The classification program classifies the photos by location and possibly also by other parameters - for example, the camera 100 may include time/date stamping means for associating time and date information with each photo in which case the photos can also be classified by these parameters. Furthermore, a camera and/or user ID can be stored with each photo.

The classification program 105 also serves as an album program enabling a user to find their photos by geographic location. To this end, a map store 104 is provided which may be on the PC or external (even on the Internet). A user wishing to view the stored photos brings up a map by selecting a geographic area (for example form a world or regional starting map or by selection from a country/region list). Superimposed on the displayed map 110 are a number of indicators showing locations for which are stored corresponding photos - clicking on these locations with a mouse (or other device) can be arranged to bring up the corresponding photo on the display. Preferably, however, to avoid cluttering the map display, the superimposed indications are kept small and larger icons are placed in

the map display margins to represent the photos, these items then being clickable to bring up the photos.

Thus, in Figure 7 small cross indicators 111 show the location of individual photos which are represented by camera-shaped icons 112. Associated with these icons could be a short title for each photo and data information. Instead of a camera-shaped icon 112, a thumbnail 113 of the photo could be displayed. Mouse-activated scroll controls 120 permit the map to be scrolled up/down/left/right as desired to bring other photos into view. Clickable button 122 permits exit from the map display.

Many refinements are possible:

- Maps could be selectively displayed at a variety of different resolutions starting at a country level, or even world level, and progressing down to street level; for this purpose clickable zoom buttons 121 are provided.
- Clusters of photos in the same area can be represented by a circle indicator 117 and a group icon 118 where the current map resolution was insufficient to allow for individual photos to be represented.
- If the density of photos in an area is too great to allow for individual representation at the highest resolution, then selecting the group icon will bring up a list of photos (preferably with date information and a short description, either input manually or generated by automatic photo analysis techniques).
- Clicking a group icon even at a lower resolution of the map display can also be arranged to bring up a corresponding list or to go to the next highest resolution.
- Since it is likely that "home" locations will have a high density of photos, a special "home" group indicator 115 and icon 116 could be defined for the current - and past - "home" locations
- Photos taken on the same holiday could be classified into a set, the set being individually selectable and possibly represented by a single icon on the lower resolution maps.
- Where date information is also recorded by the camera 110 when taking a photo, date filter can be applied by the classification program 105 so that only photos

satisfying the filter criterion appear on the map display. Similarly, where camera/user ID information is available, these parameters can be used to filter the photographs represented and displayed. Password access control can also be used to limit who in a family has access to which photos.

- Preferably, the classification program is operative to enable classification of digital photos that are input without location information by adding this data by pointing to location on the map display.

A similar location-based album to that described above can also be used to classify and access other types of recording such as sound recordings, video recordings etc.

Of course, the vast majority of cameras (or other recording devices) are not provided with location determining means. Nevertheless the foregoing location-based album can still be built up provided the user can activate a location determining device whilst located at the place a recording is being / has been / is about to be, made. In the near future, many location-determining devices (such as GPS devices) will be widely deployed; potentially more significantly, location services will become widely available to users of mobile phones (see the Annex to this specification which describes the mobile radio infrastructure and the provision of location-based services using such an infrastructure..

Thus it will become relatively easy for someone taking a photo to find out their location using their mobile phone. However what is additionally needed is some way of uniting this location information with the photographs.

One way of doing this where the camera is a digital camera is to have a communication link between the camera and mobile phone and to provide means in the phone enabling a user to trigger a location determination with the resultant location data being passed from the phone to the camera where the camera is operative to associate the data with a photograph just taken (or just about to be taken). Of course, it would also be possible to have the taking of the photo trigger the location request via the mobile phone.

Another way of uniting a digital photo and location data would be to upload the photo through the phone (via a connection between the camera and phone) to a network store either in the mobile infrastructure or accessible via the the latter (for example over a data-capable bearer service). En route to the store, or even upon loading into the store location information on the mobile phone would be requested and associated with the photo.

In many cases, however, there will be no possibility of linking the camera and phone. For these cases, the solution is to create a location log which can be correlated with the photos being taken. More particularly,

- as the camera is used to take a number of photographs, the photographs as items are distinguished from each other by an implicit (e.g. sequence position) or explicit location-independent reference associated with each;
- in association with taking each of at least some of said photographs, a mobile device (phone or e.g. a PDA with mobile radio capability) that is separate from the camera is used to provide location data indicative of the location at which the photograph was taken, this location data being stored together with an index matching the reference associated with the corresponding photograph;
- subsequently, the location data is united with the corresponding photographs by a correlation process using said references and indexes.

References can simply be position-in-sequence of photographs (in which case the corresponding indexes are similar ordering data). Alternatively, the references can be time-stamps - in this case, the indexes could be timestamps also (or, again, ordering data since timestamps are also this).

The photos can be traditional (chemical) snaps and the uniting is done by printing labels with the location data for sticking on back (preferably this location data takes the form of a map showing the location where the photo was taken) - in this case, the labels are numbered to correspond to photo numbers.

Preferably, however, the photos are digital (or digitised) and the uniting of the photos with the location information is done in a PC. Processes for effecting this uniting will be described hereinafter, it being simply noted at this stage that the location data can be readily transferred to the PC via the mobile infrastructure and the Internet if the location data has be stored in the infrastructure or a connected network (or, indeed, in a mobile phone though in this case, means can be simply incorporated into the phone for transferring data to the PC).

Whilst location information is conveniently provided using the mobile phone infrastructure, a separate GPS device could be used for obtaining and logging location data (or passing it to the camera.

The same process of separately determining location can be done for sound or other recordings, the location data being subsequently united with the recording. In the case of a sound recording, the location data could even be provided by a digital camera equipped with GPS.

It may be noted that giving a mobile phone the ability to store a location log (either in the phone itself or in the mobile infrastructure or in a connected network) is I itself a useful feature. Thus whilst many location-based services simply require a one-off provision of location data or continually monitor location, the ability for a user to selectively trigger location determination for storing the resultant data to a log has value in its own right - or example, a user may wish to store the location of places visited whilst out walking or, as described above may want to log the locations of photos taken. Since the user may also want ot use other location-based services at the same time, the user must be able to select when location information is to be logged. Further, since the user may want to log location information about different topics, the mobile phone (or other location-determination-triggering device) preferably permits a user to set up more than one log at a time and to select to which log a particular item of location data is to be stored.

The situation may arise that a user would like to take a photograph of a place or item but ahs run out of film / storage or is present at a time when it is not possible to take a photograph (at night, in heavy rain or mist, etc). In such cases, the user can record their location in their photo location log and subsequently retrieve from the Web a photograph similar to that the user wanted to take. Preferably, this process would be automatically initiated when a user attempted to unite his digitised photos with the information in his photo location log. Preferably also, more than one photograph will be searched for on the basis of location with the user being then presented with a choice of third-party photos to add to the user's own photo album.

Of course, where a camera is provided with location determining means for location stamping photos, means can be provided to enable additional location information to be stored without the need to actually record a photograph thereby enabling the camera to be the log of desired but untaken photos. Preferably the desired-photo location data is stored in sequence with location data associated with photos actually taken.

Considering now the issue of matching photos with location data, one efficient way of doing this is by time-stamping digital photos in the camera and time-stamping the location data that is separately created at the same time (approximately) in a different device. Because different clocks are used for the two time stamps, absolute time is not reliable for matching auxiliary data with photos. Instead the pattern of timestamps (i.e. time-interval related data) can be used to perform a match.

This remains true even when there are additional entries in either the photo collection or the auxiliary data collection that have no counterpart in the other collection. - see Figure 8.

The same approach could be used for matching other types of auxiliary data (and not just location data - for example sound clip data) with photos; again, the matching process can be used with any type of recording, not just photos.

As already noted, matching cn also be done on the basis of sequence number and this can be done even where the photos are only physical items - in this case, the location data is printed out on numbered self-adhesive labels than can be stuck to the back of the corresponding photos.

Returning to matching location data and photos on a PC (or similar device), whilst using sequence numbers, for example, seems an easy way to match up a set of photos with a corresponding set of location-data items, it is quite likely that there will be additions/omissions in one set as compared to the other. As a result the match between the sets will be imperfect. . Mismatching may also arise where other correlation keys (that is, not sequence position) are used.

However, it may generally be assumed that the ordering of entries is the same for both sets

To correct the match up, a user must intervene and manually correct erroneous associations between entries in the two lists. For example, if photos and location data are associated through a map display with a lead line from each photo to its map location (the location data having been turned into markers on the map), then to correct an erroneous association, a user drags the map end of the lead line to the correct location marker on the map - or drags the photo end of the lead line to the correct photo (or simply clicks on the matching entries in turn).

To minimize the number of times this needs to be done, use is made of the consistency of the ordering of both sets - in particular, the associations of photos and location data for entries later in the orderings than a just-corrected association, are re-matched taking into account the corrected association. If these entries include an already corrected association, this latter is not disturbed.

ANNEX A - Mobile radio infrastructure; Location Determination

This Annex forms an integral part of the specification.

Communication infrastructures suitable for mobile users (in particular, though not exclusively, cellular radio infrastructures) have now become widely adopted. Whilst the primary driver has been mobile telephony, the desire to implement mobile data-based services over these infrastructures, has led to the rapid development of data-capable bearer services across such infrastructures. This has opened up the possibility of many Internet-based services being available to mobile users.

By way of example, Figure 1 shows one form of known communication infrastructure for mobile users providing both telephony and data-bearer services. In this example, a mobile entity 20, provided with a radio subsystem 22 and a phone subsystem 23, communicates with the fixed infrastructure of GSM PLMN (Public Land Mobile Network) 10 to provide basic voice telephony services. In addition, the mobile entity 20 includes a data-handling subsystem 25 interworking, via data interface 24, with the radio subsystem 22 for the transmission and reception of data over a data-capable bearer service provided by the PLMN; the data-capable bearer service enables the mobile entity 20 to communicate with a service system 40 connected to the public Internet 39. The data handling subsystem 25 supports an operating environment 26 in which applications run, the operating environment including an appropriate communications stack.

More particularly, the fixed infrastructure 10 of the GSM PLMN comprises one or more Base Station Subsystems (BSS) 11 and a Network and Switching Subsystem NSS 12. Each BSS 11 comprises a Base Station Controller (BSC) 14 controlling multiple Base Transceiver Stations (BTS) 13 each associated with a respective "cell" of the radio network. When active, the radio subsystem 22 of the mobile entity 20 communicates via a radio link with the BTS 13 of the cell in which the mobile entity is currently located. As regards the NSS 12, this comprises one or more Mobile Switching Centers (MSC) 15

together with other elements such as Visitor Location Registers 32 and Home Location Register 32.

When the mobile entity 20 is used to make a normal telephone call, a traffic circuit for carrying digitised voice is set up through the relevant BSS 11 to the NSS 12 which is then responsible for routing the call to the target phone (whether in the same PLMN or in another network).

With respect to data transmission to/from the mobile entity 20, in the present example three different data-capable bearer services are depicted though other possibilities exist. A first data-capable bearer service is available in the form of a Circuit Switched Data (CSD) service; in this case a full traffic circuit is used for carrying data and the MSC 32 routes the circuit to an InterWorking Function IWF 34 the precise nature of which depends on what is connected to the other side of the IWF. Thus, IWF could be configured to provide direct access to the public Internet 39 (that is, provide functionality similar to an IAP - Internet Access Provider IAP). Alternatively, the IWF could simply be a modem connecting to a PSTN; in this case, Internet access can be achieved by connection across the PSTN to a standard IAP.

A second, low bandwidth, data-capable bearer service is available through use of the Short Message Service that passes data carried in signalling channel slots to an SMS unit which can be arranged to provide connectivity to the public Internet 39.

A third data-capable bearer service is provided in the form of GPRS (General Packet Radio Service which enables IP (or X.25) packet data to be passed from the data handling system of the mobile entity 20, via the data interface 24, radio subsystem 21 and relevant BSS 11, to a GPRS network 17 of the PLMN 10 (and vice versa). The GPRS network 17 includes a SGSN (Serving GPRS Support Node) 18 interfacing BSC 14 with the network 17, and a GGSN (Gateway GPRS Support Node) interfacing the network 17 with an external network (in this example, the public Internet 39). Full details of GPRS can be found in the ETSI (European Telecommunications Standards Institute) GSM 03.60 specification. Using

GPRS, the mobile entity 20 can exchange packet data via the BSS 11 and GPRS network 17 with entities connected to the public Internet 39.

The data connection between the PLMN 10 and the Internet 39 will generally be through a firewall 35 with proxy and/or gateway functionality.

Different data-capable bearer services to those described above may be provided, the described services being simply examples of what is possible.

In Figure 1, a service system 40 is shown connected to the Internet 40, this service system being accessible to the OS/application 26 running in the mobile entity by use of any of the data-capable bearer services described above. The data-capable bearer services could equally provide access to a service system that is within the domain of the PLMN operator or is connected to another public or private data network.

With regard to the OS/application software 26 running in the data handling subsystem 25 of the mobile entity 20, this could, for example, be a WAP application running on top of a WAP stack where "WAP" is the Wireless Application Protocol standard. Details of WAP can be found, for example, in the book "Official Wireless Application Protocol" Wireless Application Protocol Forum, Ltd published 1999 Wiley Computer Publishing. Where the OS/application software is WAP compliant, the firewall will generally also serve as a WAP proxy and gateway. Of course, OS/application 26 can comprise other functionality (for example, an e-mail client) instead of, or additional to, the WAP functionality.

The mobile entity 20 may take many different forms. For example, it could be two separate units such as a mobile phone (providing elements 22-24) and a mobile PC (data-handling system 25) coupled by an appropriate link (wireline, infrared or even short range radio system such as Bluetooth). Alternatively, mobile entity 20 could be a single unit such as a mobile phone with WAP functionality. Of course, if only data transmission/reception is required (and not voice), the phone functionality 24 can be omitted; an example of this is a PDA with built-in GSM data-capable functionality whilst another example is a digital

camera (the data-handling subsystem) also with built-in GSM data-capable functionality enabling the upload of digital images from the camera to a storage server.

Whilst the above description has been given with reference to a PLMN based on GSM technology, it will be appreciated that many other cellular radio technologies exist and can typically provide the same type of functionality as described for the GSM PLMN 10.

Recently, must interest has been shown in "location-based", "location-dependent", or "location-aware" services for mobile users, these being services that take account of the current location of the user (or other mobile party). The most basic form of this service is the emergency location service whereby a user in trouble can press a panic button on their mobile phone to send an emergency request-for-assistance message with their location data appended. Another well known location-based service is the provision of traffic and route-guiding information to vehicle drivers based on their current position. A further known service is a "yellow pages" service where a user can find out about amenities (shops, restaurants, theatres, etc.) local to their current location. The term "location-aware services" will be used herein to refer generically to these and similar services where a location dependency exists.

Location-aware services all require user location as an input parameter. A number of methods already exist for determining the location of a mobile user as represented by an associated mobile equipment. Example location-determining methods will now be described with reference to Figures 2 to 5. As will be seen, some of these methods result in the user knowing their location thereby enabling them to transmit it to a location-aware service they are interested in receiving, whilst other of the methods result in the user's location becoming known to a network entity from where it can be supplied directly to a location-aware service (generally only with the consent of the user concerned). It is to be understood that additional methods to those illustrated in Figures 2 to 5 exist.

As well as location determination, Figures 2 to 5 also illustrate how the mobile entity requests a location-aware service provided by service system 40. In the present examples, the request is depicted as being passed over a cellular mobile network (PLMN 10) to the service system 40. The PLMN is, for example, similar to that depicted in Figure 1 with the service request being made using a data-capable bearer service of the PLMN. The service system 40 may be part of the PLMN itself or connected to it through a data network such as the public Internet. It should, however, be understood that infrastructure other than a cellular network may alternatively be used for making the service request

The location-determining method illustrated in Figure 2 uses an inertial positioning system 50 provided in the mobile entity 20A, this system 50 determining the displacement of the mobile entity from an initial reference position. When the mobile entity 20A wishes to invoke a location-aware service, it passes its current position to the corresponding service system 40 along with the service request 51. This approach avoids the need for an infrastructure to provide an external frame of reference; however, cost, size and long-term accuracy concerns currently make such systems unattractive for incorporation into mass-market handheld devices.

Figure 3 shows two different location-determining methods both involving the use of local, fixed-position, beacons here shown as infra-red beacons IRD though other technologies, such as short-range radio systems (in particular, "Bluetooth" systems) may equally be used. The right hand half of Figure 3 show a number of independent beacons 55 that continually transmit their individual locations. Mobile entity 20B is arranged to pick up the transmissions from a beacon when sufficiently close, thereby establishing its position to the accuracy of its range of reception. This location data can then be appended to a request 59 made by the mobile entity 20B to a location-aware service available from service system 40. A variation on this arrangement is for the beacons 55 to transmit information which whilst not directly location data, can be used to look up such data (for example, the data may be the Internet home page URL of a store housing the beacon 55 concerned, this home page giving the store location - or at least identity, thereby enabling look-up of location in a directory service).

In the left-hand half of Figure 3, the IRB beacons 54 are all connected to a network that connects to a location server 57. The beacons 54 transmit a presence signal and when mobile entity 20C is sufficiently close to a beacon to pick up the presence signal, it responds by sending its identity to the beacon. (Thus, in this embodiment, both the beacons 54 and mobile entity 20C can both receive and transmit IR signals whereas beacons 55 only transmit, and mobile entity 20B only receives, IR signals). Upon a beacon 54 receiving a mobile entity's identity, it sends out a message over network 56 to location server 57, this message linking the identity of the mobile entity 20C to the location of the relevant beacon 54. Now when the mobile entity wishes to invoke a location-aware service provided by the service system 40, since it does not know its location it must include it's identity in the service request 58 and rely on the service system 40 to look up the current location of the mobile entity in the location server 57. Because location data is personal and potentially very sensitive, the location server 57 will generally only supply location data to the service system 40 after the latter has produced an authorizing token supplied by the mobile entity 20B in request 58. It will be appreciated that whilst service system 40 is depicted as handling service requests form both types of mobile entity 20 B and 20C, separate systems 40 may be provided for each mobile type (this is likewise true in respect of the service systems depicted in Figures 4 and 5).

Figure 4 depicts several forms of GPS location-determining system. On the left-hand side of Figure 4, a mobile entity 20D is provided with a standard GPS module and is capable of determining the location of entity 20D by picking up signals from satellites 60. The entity 20D can then supply this location when requesting, in request 61, a location-aware service from service system 40.

The right-hand side of Figure 4 depicts, in relation to mobile entity 20E, two ways in which assistance can be provided to the entity in deriving location from GPS satellites. Firstly, the PLMN 10 can be provided with fixed GPS receivers 62 that each continuously keep track of the satellites 60 visible from the receiver and pass information in messages 63 to local mobile entities 20E as to where to look for these satellites and estimated signal

arrival times; this enables the mobile entities 20E to substantially reduce acquisition time for the satellites and increase accuracy of measurement (see "Geolocation Technology Pinpoints Wireless 911 calls within 15 Feet" 1-Jul-99 Lucent Technologies, Bell Labs). Secondly, as an alternative enhancement, the processing load on the mobile entity 20E can be reduced and encoded jitter removed using the services of network entity 64 (in or accessible through PLMN 10).

One the mobile unit 20E has determined its location, it can pass this information in request 65 when invoking a location-aware service provided by service system 40.

Figure 5 depicts two general approaches to location determination from signals present in a cellular radio infrastructure. First, it can be noted that in general both the mobile entity and the network will know the identity of the cell in which the mobile entity currently resides, this information being provided as part of the normal operation of the system. (Although in a system such as GSM, the network may only store current location to a resolution of a collection of cells known as a "location area", the actual current cell ID will generally be derivable from monitoring the signals exchanged between the BSC 14 and the mobile entity). Beyond current basic cell ID, it is possible to get a more accurate fix by measuring timing and/or directional parameters between the mobile entity and multiple BTSs 13, these measurement being done either in the network or the mobile entity (see, for example, International Application WO 99/04582 that describes various techniques for effecting location determination in the mobile and WO 99/55114 that describes location determination by the mobile network in response to requests made by location-aware applications to a mobile location center - server- of the mobile network).

The left-hand half of Figure 5 depicts the case of location determination being done in the mobile entity 20F by, for example, making Observed Time Difference (OTD) measurements with respect to signals from BTSs 13 and calculating location using a knowledge of BTS locations. The location data is subsequently appended to a service request 66 sent to service system 40 in respect of a location-aware service. The calculation load on mobile entity 20F could be reduced and the need for the mobile to know BTS

locations avoided, by having a network entity do some of the work. The right-hand half of Figure 5 depicts the case of location determination being done in the network, for example, by making Timing Advance measurements for three BTSs 13 and using these measurements to derive location (this derivation typically being done in a unit associated with BSC 14). The resultant location data is passed to a location server 67 from where it can be made available to authorised services. As for the mobile entity 20C in Figure 3, when the mobile entity 20G of Figure 5 wishes to invoke a location-aware service available on service system 50, it sends a request 69 including an authorisation token and its ID (possible embedded in the token) to the service system 40; the service system then uses the authorisation token to obtain the current location of the mobile entity 20G from the location server 67.

In the above examples, where the mobile entity is responsible for determining location, this will generally be done only at the time the location-aware service is being requested. Where location determination is done by the infrastructure, it may be practical for systems covering only a limited number of users (such as the system illustrated in the left-hand half of Figure 2 where a number of infrared beacons 54 will cover a generally fairly limited) for location-data collection to be done whenever a mobile entity is newly detected by an IRB, this data being passed to location server 57 where it is cached for use when needed. However, for systems covering large areas with potentially a large number of mobile entities, such as the Figure 5 system, it is more efficient to effect location determination as and when there is a perceived need to do so; thus, location determination may be triggered by the location server 67 in response to the service request 68 from the mobile entity 20G or the mobile entity may, immediately prior to making request 68, directly trigger BSC 14 to effect a location determination and feed the result to location server 67.

Further with respect to the location servers 57, 67, whilst access authorisation by location-aware services has been described as being through authorisation tokens supplied by the mobile entities concerned, other authorisation techniques can be used. In particular, a location-aware service can be prior authorised with the location server in respect of particular mobile entities; in this case, each request from the service for location data needs

only to establish that the request comes from a service authorised in respect of the mobile entity for which the location data is requested.

As already indicated, Figures 2 to 5 depict only some examples of how location determination can be achieved, there being many other possible combinations of technology used and where in the system the location-determining measurements are made and location is calculated, stored and used .Thus, the location-aware service may reside in the mobile entity whose location is of interest, in a network-connected service system 40 (as illustrated), or even in another mobile entity. Furthermore, whilst in the examples of Figures 2 to 5, invocation of the location-aware service has been by the mobile entity whose location is of interest, the nature of the location-aware service may be such that it is invoked by another party (including, potentially, the PLMN itself). In this case, unless the invoking party already knows the location of he mobile entity and can pass this information to the location-aware service (which may, for example, may be situation where the PLMN invokes the service), it is the location-aware service that is responsible for obtaining the required location data, either by sending a request to the mobile entity itself or by requesting the data from a location server. Unless the location server already has the needed information in cache, the server proceeds to obtain the data either by interrogating the mobile entity or by triggering infrastructure elements to locate the mobile. For example, where a location-aware service running on service system 40 in Figure 5 needs to find the location of mobile 20G, it could be arranged to do so by requesting this information from location server 67 which in turn requests the location data from the relevant BSC, the latter then making the necessary determination using measurements from BTSs 13. Figure 6 depicts the various possibilities discussed above.

CLAIMS

1. An electronic album of recordings, each recording having associated location data indicative of a location associated with the recording, the album comprising a user interface with a display for presenting map displays, and means for superimposing on a displayed map indicators showing the locations of recordings for at least a subset of the recordings located by their location data as within the displayed area of the map.

2. A method of associating location data with photographs, comprising the steps of:

(a) - using a camera to take a number of photographs, the photographs as items being distinguished from each other by an implicit or explicit location-independent reference associated with each;

(b) - in association with taking each of at least some of said photographs, using a mobile device that is separate from the camera and includes location-providing means, for providing location data indicative of the location at which the photograph was taken;

(c) - for each photograph in respect of which location data has been provided in step (b), storing that data together with an index matching the reference associated with the corresponding photograph;

(d) - subsequently uniting the location data with the corresponding photographs by a correlation process using said references and indexes.

3. A method of completing a set of photos, wherein a set of photographs are taken and corresponding taken-photo location data recorded, and wherein additional desired-photo location data is recorded along with said taken-photo data, the desired photo location data being subsequently used to retrieve one or more photos of each location so recorded.

4. A digital camera including location-providing means for time-stamping photos taken with the camera, the camera including means enabling user-triggered recording of location data independently of the taking of a photo.

5. A method of matching recordings with auxiliary data, such as location data, comprising the steps of:

- time stamping the recordings from one clock;
- time stamping the recordings from another clock, and
- subsequently matching the pattern of time intervals between timestamps of the recordings with the pattern of time intervals between timestamps of the auxiliary data..

6. A method of matching recording in a sequence of recordings with location-data items in a sequence of such items, the method comprising the steps of:

- effecting an initial match based on sequence order in the two sequences,
- correcting a mismatch by user input to match a member of one sequence with a member of the other sequence,
- automatically adjusting downstream matches, that are not user-determined matches, to take account of the adjustment in correspondence between the sequences.

7. A handheld mobile device comprising:

- selection means for enabling a user to select a location log; and
- user-activated location-providing means operative when activated by a user currently in possession of the device to provide location data indicative of the current location of the device and to cause the storage of that data in said location log, the location data being stored in a corresponding respective log item together with an associated reference serving to distinguish that item amongst other items in the same log.

8. A device according to claim 7, wherein the selection means permits the user to select between multiple location logs for the storage of a particular item of location data.

ABSTRACT

Recordings with associated location data

An electronic album of recordings, each recording having associated location data indicative of a location associated with the recording, the album comprising a user interface with a display for presenting map displays, and means for superimposing on a displayed map indicators showing the locations of recordings for a least a subset of the recordings located by their location data as within the displayed area of the map.

(Fig. 7)

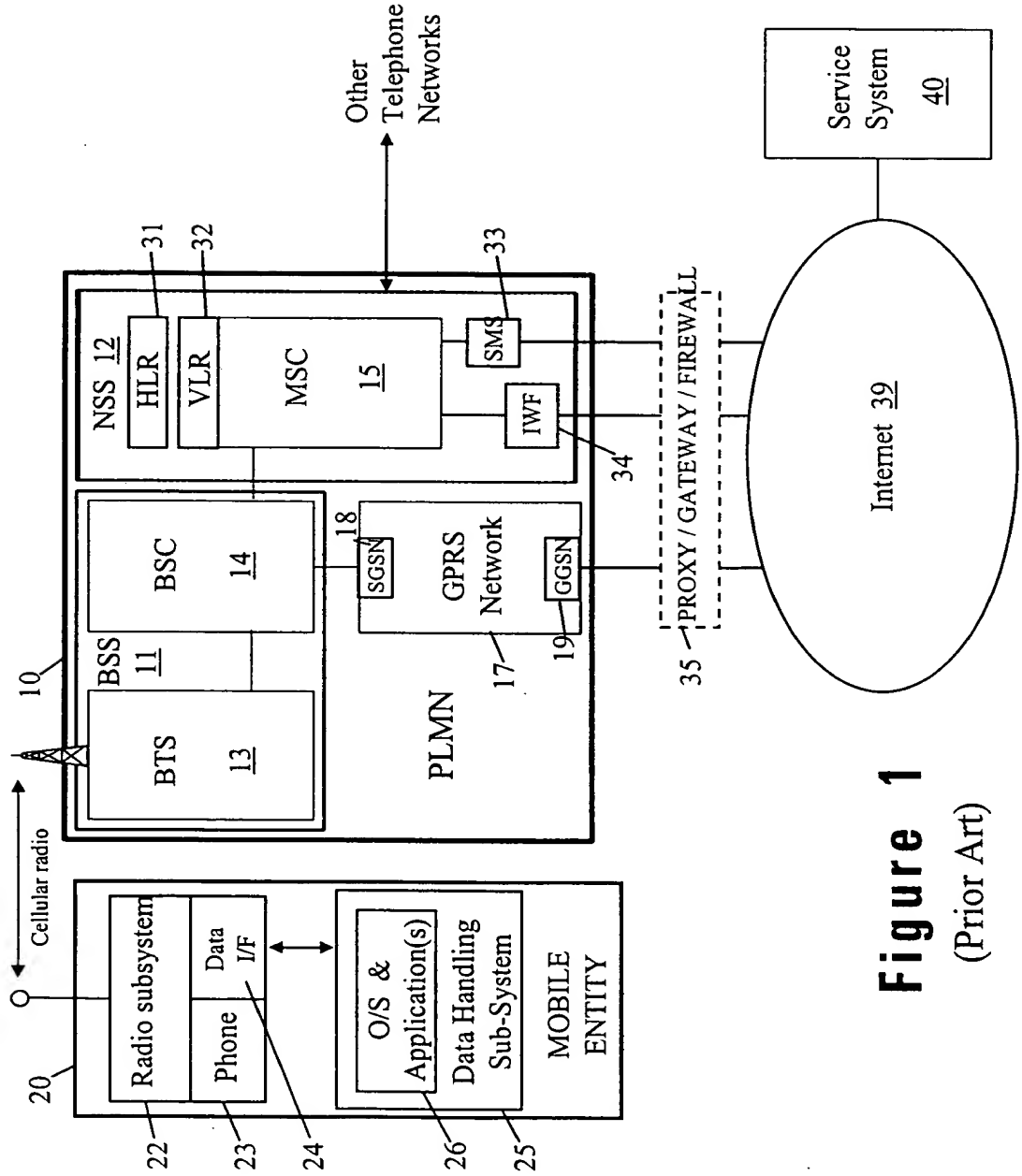

Figure 1
(Prior Art)

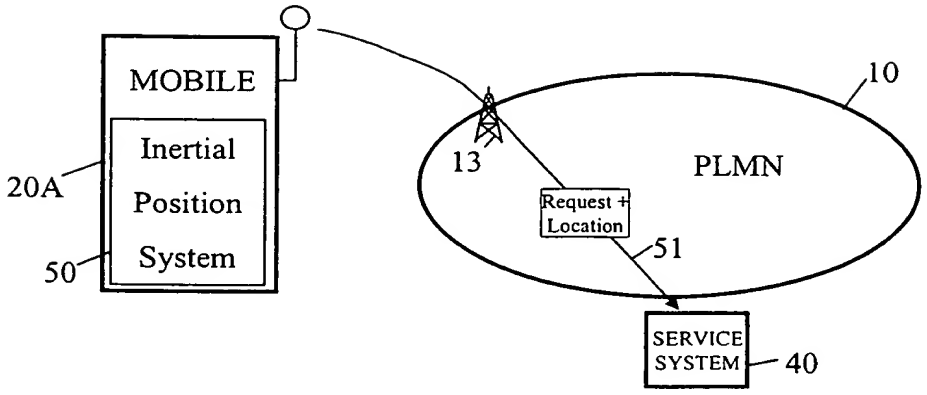

Figure 2
(Prior Art)

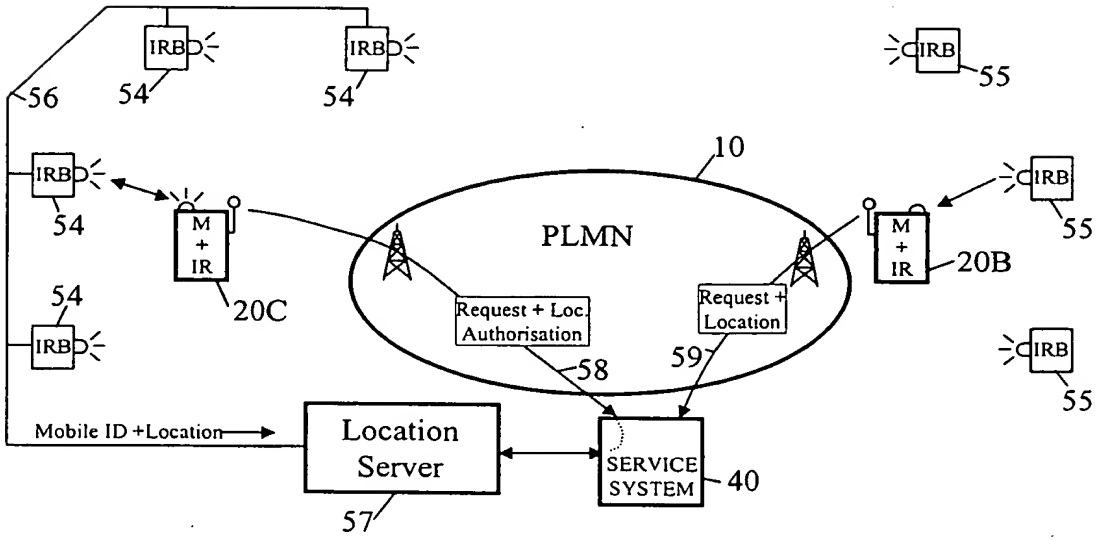

Figure 3
(Prior Art)

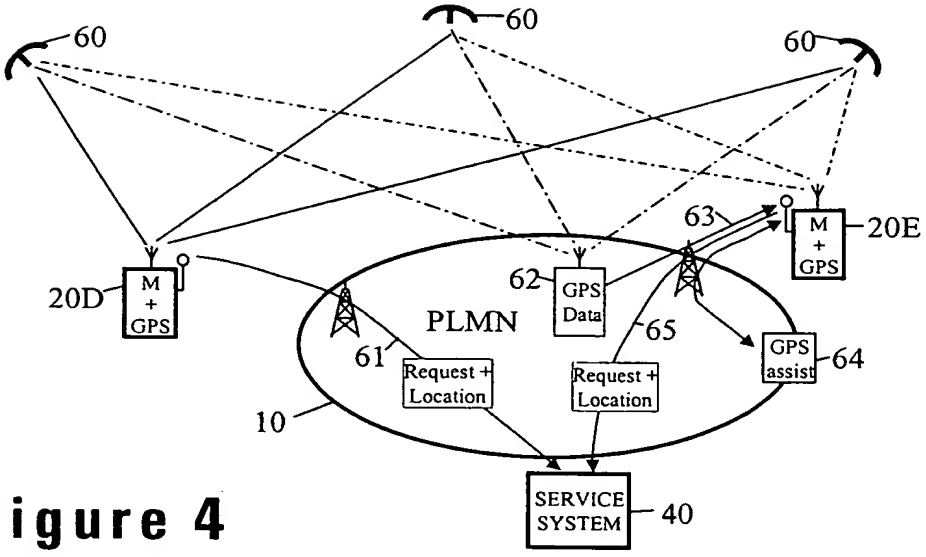

Figure 4
(Prior Art)

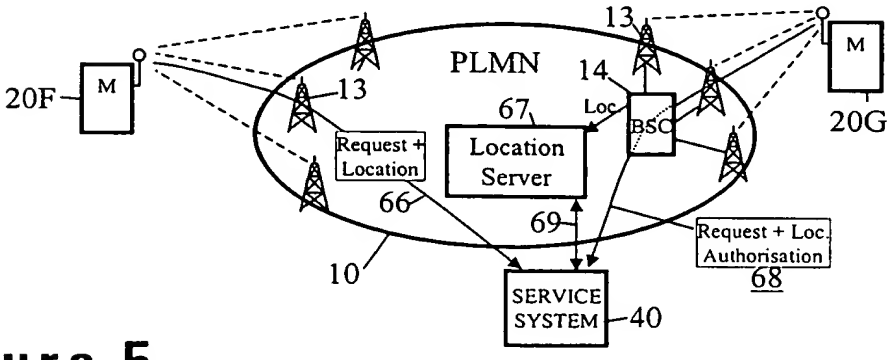

Figure 5
(Prior Art)

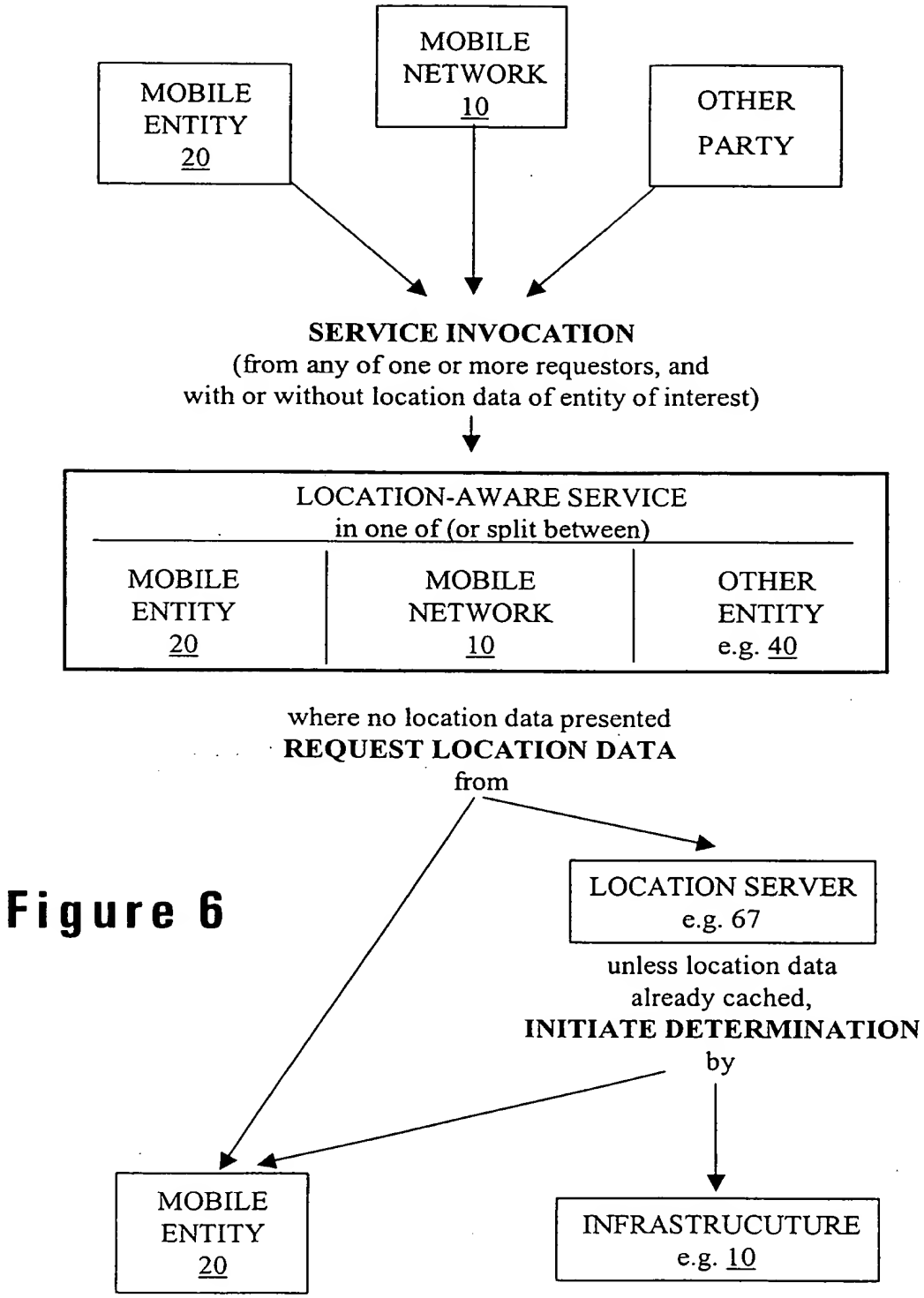
MOBILE ENTITY 20
MOBILE NETWORK 10
OTHER PARTY
SERVICE INVOCATION
(from any of one or more requestors, and with or without location data of entity of interest)
LOCATION-AWARE SERVICE
in one of (or split between)
MOBILE ENTITY 20
MOBILE NETWORK 10
OTHER ENTITY e.g. 40
where no location data presented
REQUEST LOCATION DATA
from
LOCATION SERVER e.g. 67
unless location data already cached,
INITIATE DETERMINATION
by
MOBILE ENTITY 20
INFRASTRUCUTURE e.g. 10

Figure 6

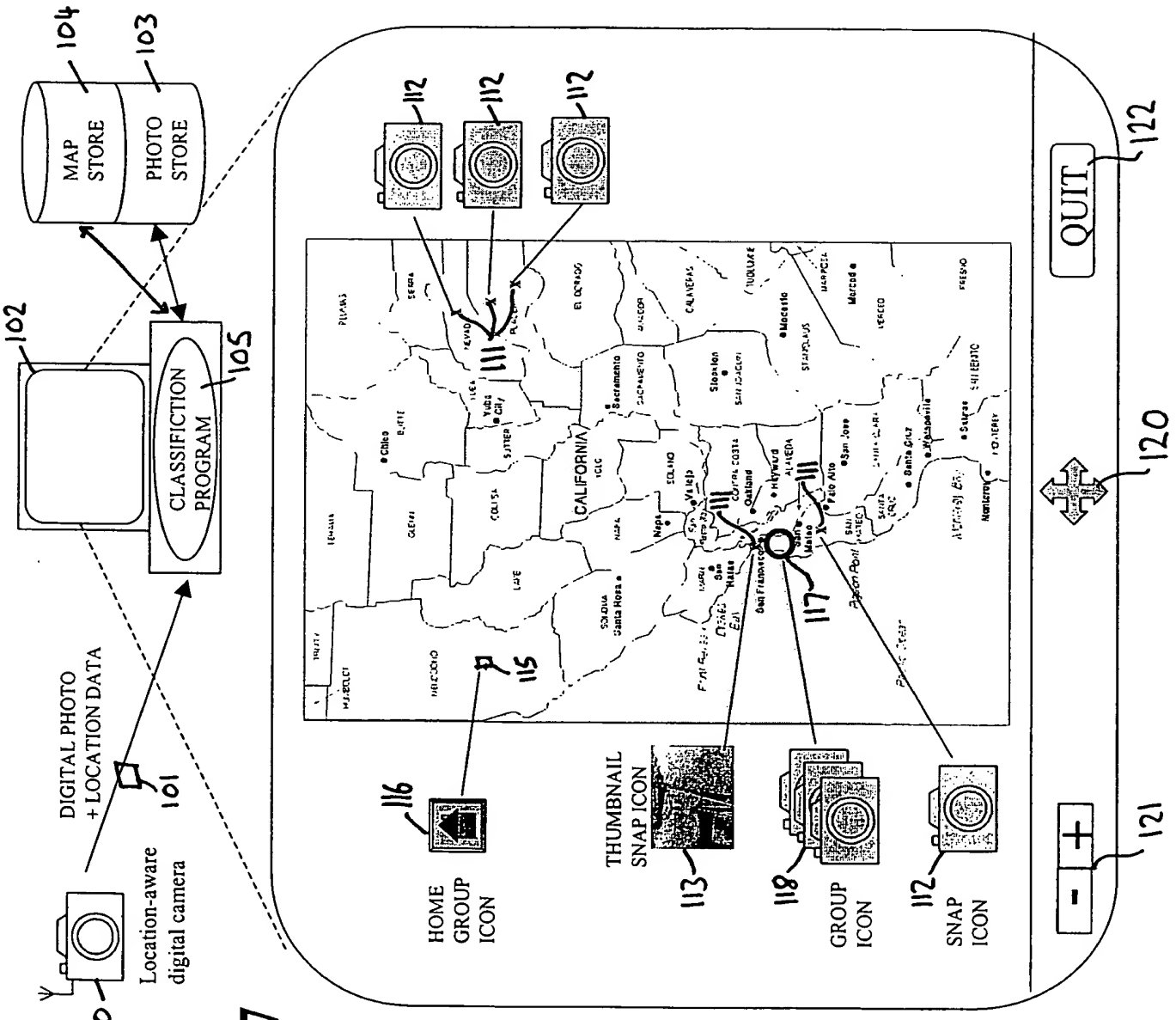
104
MAP STORE
103
PHOTO STORE
102
CLASSIFICTION PROGRAM
105
DIGITAL PHOTO + LOCATION DATA
101
Location-aware digital camera
100
112
112
112
111
CALIFORNIA
117
116
HOME GROUP ICON
115
THUMBNAIL SNAP ICON
113
118
GROUP ICON
112
SNAP ICON
QUIT
122
120
121

Fig. 7

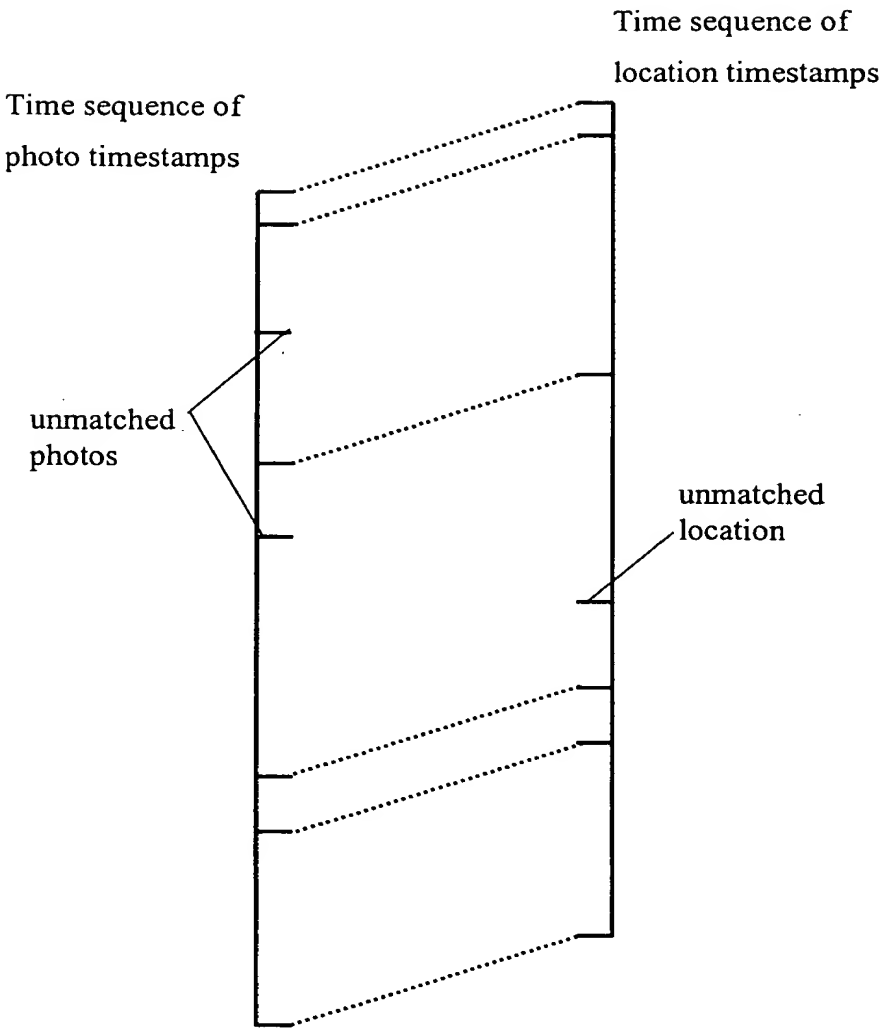
Time sequence of
location timestamps
Time sequence of
photo timestamps
unmatched
photos
unmatched
location
sequences matched on pattern
of time intervals notwithstanding
omissions

Figure 8